

WHAT IS CLAIMED IS:

1. An apparatus comprising:
 - a first attracting member opposing a second attracting member;
 - at least one target member situated between the first attracting member and the second attracting member;
 - at least one actuator that moves at least one of the first attracting member, the second attracting member, and the target member, so as to adjust the distance between the target member and at least one of the first and second attracting members;
 - at least one sensor that detects a gap between the target member and at least one of the first and second attracting members; and
 - a controller coupled to the actuator to adjust the size of the gap between the target member and at least one of the first and second attracting members.
2. The apparatus of claim 1, further comprising:
 - a fine stage device that adjusts the position of a stage, wherein the target member is connected to the fine stage device.
3. The apparatus of claim 2, wherein
 - at least one of the first and second attracting members comprises a core member and a coil assembly that is disposed near the core member; and
 - the controller provides a current to the coil assembly to generate a force that accelerates the fine stage device.

4. The apparatus of claim 2, wherein
at least one of the first and second attracting members comprises a core member
and a coil assembly that is disposed near the core member; and
the controller provides a current to the coil assembly to generate a force that
decelerates the fine stage device.
5. The apparatus of claim 2, wherein the actuator provides acceleration or
deceleration of the fine stage through a pair of members formed by the target member
and one of the first and second attracting members.
6. The apparatus of claim 1, further comprising a framework that connects the first
attracting member and the second attracting member.
7. The apparatus of claim 6, wherein the actuator is connected to the framework.
8. The apparatus of claim 6, wherein moving the framework controls the gap.
9. A method of moving a fine stage device, the method comprising:
connecting a fine stage device to a coarse stage device, the coarse stage device
comprising an attracting framework comprising opposing attracting members and at
least one target member, wherein the target member is located in a gap between the
attracting members and connected to the fine stage device; and

manipulating the relative position of the target member by moving the attracting framework to decrease the distance between one of the attracting members and the target member.

10. The method of claim 9, wherein at least one of the attracting members comprises a core member and a coil assembly that is disposed near the core member, and the method further comprises:

providing a current to the coil assembly to cause acceleration movement of the fine stage device.

11. The method of claim 9, wherein at least one of the attracting members comprises a core member and a coil assembly that is disposed near the core member, and the method further comprises:

providing a current to the coil assembly to cause deceleration movement of the fine stage device.

12. A dual-force-mode fine stage apparatus comprising:

a first assembly including a target member;

a second assembly including a first attracting member and a second attracting member located on opposite sides of the target member; and

an actuator associated with the second assembly, wherein the actuator moves the second assembly to adjust the relative distance between the target member and the first attracting member.

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13. A dual-force-mode stage assembly comprising:

- a fine stage assembly;
- a coarse stage assembly, the coarse stage assembly comprising
 - opposing attracting members, each capable of drawing an electric current,
 - with a gap between the attracting member elements; and
 - a target member in the gap, the target member being connected to the fine stage assembly,
 - wherein the coarse stage assembly is moveable along an axis independently of the fine stage assembly through a coarse actuator;
 - a sensor configured to detect a position of the target member so that the relative distance between the target member and the attracting members can be determined;
- and
- a controller coupled to the coarse actuator of the coarse stage assembly to control the position of the attracting members.

14. A stage device comprising:

- a table that retains an object;
- a first attracting member opposing a second attracting member;
- at least one target member situated between the first attracting member and the second attracting member, wherein the table is attached to at least one of the first attracting member, the second attracting member, and the target member;

at least one actuator that moves at least one of the first attracting member, the second attracting member, and the target member, so as to adjust the distance between the target member and at least one of the first and second attracting members;

at least one sensor that detects a gap between the target member and at least one of the first and second attracting members; and

a controller coupled to the actuator to adjust the size of the gap between the target member and at least one of the first and second attracting members.

15. An exposure apparatus comprising:

an illumination system that irradiates radiant energy; and

a stage device that carries an object disposed on a path of the radiant energy,

wherein the stage device comprises:

a table that retains the object;

a first attracting member opposing a second attracting member;

at least one target member situated between the first attracting member and the second attracting member, wherein the table is attached to at least one of the first attracting member, the second attracting member, and the target member;

at least one actuator that moves at least one of the first attracting member, the second attracting member, and the target member, so as to adjust the distance between the target member and at least one of the first and second attracting members;

at least one sensor that detects a gap between the target member and at least one of the first and second attracting members; and

a controller coupled to the actuator to adjust the size of the gap between the target member and at least one of the first and second attracting members.

16. The exposure apparatus of claim 15, wherein the object comprises a wafer or a reticle.

17. A method for operating an exposure apparatus, the method comprising employing a stage device to position an object, wherein the stage device comprises:

a table that retains the object;

a first attracting member opposing a second attracting member;

at least one target member situated between the first attracting member and the second attracting member, wherein the table is attached to at least one of the first attracting member, the second attracting member, and the target member;

at least one actuator that moves at least one of the first attracting member, the second attracting member, and the target member, so as to adjust the distance between the target member and at least one of the first and second attracting members;

at least one sensor that detects a gap between the target member and at least one of the first and second attracting members; and

a controller coupled to the actuator to adjust the size of the gap between the target member and at least one of the first and second attracting members.

18. The method of claim 17, wherein the object comprises a wafer or a reticle.

19. A method for making a micro-device, the method comprising a photolithography process using a stage device to position an object, wherein the stage device comprises:

a table that retains the object;

a first attracting member opposing a second attracting member;

at least one target member situated between the first attracting member and the second attracting member, wherein the table is attached to at least one of the first attracting member, the second attracting member, and the target member;

at least one actuator that moves at least one of the first attracting member, the second attracting member, and the target member, so as to adjust the distance between the target member and at least one of the first and second attracting members;

at least one sensor that detects a gap between the target member and at least one of the first and second attracting members; and

a controller coupled to the actuator to adjust the size of the gap between the target member and at least one of the first and second attracting members.

20. The method of claim 19, wherein the object comprises a wafer or a reticle.

21. A method for making a semiconductor device on a wafer, the method comprising operating an exposure apparatus via a stage device to position an object, wherein the stage device comprises:

a table that retains the object;

a first attracting member opposing a second attracting member;

at least one target member situated between the first attracting member and the second attracting member, wherein the table is attached to at least one of the first attracting member, the second attracting member, and the target member;

at least one actuator that moves at least one of the first attracting member, the second attracting member, and the target member, so as to adjust the distance between the target member and at least one of the first and second attracting members;

at least one sensor that detects a gap between the target member and at least one of the first and second attracting members; and

a controller coupled to the actuator to adjust the size of the gap between the target member and at least one of the first and second attracting members.

22. The method of claim 21, wherein the object comprises a wafer or a reticle.

23. The method of claim 21, wherein the table comprises a wafer stage or a reticle stage.